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COMPUTATIONAL CHALLENGES IN GRANULAR FLOWS

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ABSTRACT

Granular flows are ubiquitous in many fields such as industrial processing, mining, energy production, food powders, biology, geoscience, or mechanical and civil engineering. The analysis and prediction of these flows is challenging as they often occur in complex geometries and their rheology can be influenced by many microscopic and macroscopic parameters. Different computational approaches exist:

Discrete particle methods (DPMs) are a very powerful computational tool that allows the simulation of individual particles with complex interactions, arbitrary shapes, in arbitrary geometries, by solving Newton's laws for each particle. This means elaborate interactions of sintering, breaking and agglomeration of particles can be captured by the contact model. However, this method is computationally expensive and is not able to deal with the huge number of particles involved in full-scale industrial or environmental situations.

On the other hand, continuum methods are able to simulate the volume of real industrial flows, but have to make averaging approximations reducing the properties of a huge number of particles to a handful of averaged quantities. Once these averaged parameters have been tuned via experimental data these models can be surprisingly accurate; but, a model tuned for one flow configuration often has no prediction power for another setup. It is clear that new hybrid or coupled methods are required that combine the advantages of both continuum and discrete computational approaches.

An accurate prediction of granular flow is very important for the efficiency and safety of the design of many engineering and industrial applications. This mini-symposium aims to provide an opportunity for physicists, engineers, applied mathematicians and computational scientists to discuss the current progress and latest advancements in the field of advanced numerical methods for predicting granular flows. The focus will be on new computational methods, improved algorithms and the modeling of interesting industrial and academic applications. Submissions can include, but are not limited to the following aspects: capturing shape and surface properties of grains; erosion and deposition; segregation; sintering; fluid-particle interaction; applications; and, description of benchmark problems for the community.